

ISWS-74-BUL60(10)

BULLETIN 60-10

STATE OF ILLINOIS

DEPARTMENT OF REGISTRATION AND EDUCATION



# *Public Groundwater Supplies in Hardin County*

by DOROTHY M. WOLLER

ILLINOIS STATE WATER SURVEY

URBANA

1974

# PUBLIC GROUNDWATER SUPPLIES IN HARDIN COUNTY

by Dorothy M. Woller

## Introduction

This publication presents all available information on production wells used for public groundwater supplies in Hardin County. Bulletin 60, which is divided by county into separate publications, supersedes Bulletin 40 and its Supplements 1 and 2.

The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Systems and wells described furnish water for drinking or general domestic use in: 1) incorporated municipalities; 2) unincorporated communities where 10 or more separate lots or properties are being served or are intended to be served; 3) state-owned parks and memorials; and 4) state-owned educational, charitable, or penal institutions.

This report includes separate descriptions for 2 groundwater supply systems furnishing water to 1 municipality, 1 water district, and 1 state park in Hardin County. These are preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for municipal use. An explanation of the format used in the descriptions is also given.

**Acknowledgments.** This report was prepared under the general direction of Dr. William C. Ackermann, Chief of the Illinois State Water Survey, and John B. Stall, Head of the Hydrology Section. The work was done under the direct guidance of William H. Walker, Hydrologist. Special thanks are given to J. P. Gibb, Assistant Hydrologist, who checked all of the data and reviewed the manuscript. Mrs. J. L. Ivens and Mrs. P. A. Motherway edited the manuscript and Suzi L. Scherbroeck typed the camera-copy. The chemical analyses were made by personnel of the Illinois Environmental Protection Agency under the supervision of John P. Anderson. Ross D. Brower, Assistant Geologist, Illinois State Geological Survey, reviewed the geological discussion. Grateful acknowledgment also is given to consulting engineers, well drillers, water superintendents, and municipal officials who have provided valuable information used in this report.

## Geology

The geology of Hardin County is described generally in Illinois State Geological Survey Circular 212, *Groundwater Geology in Southern Illinois*. The following brief discussion of geologic conditions in the county is taken largely from that publication. For a more detailed definition of the geology in this portion of the state, the reader is referred to the State Geological Survey which is located on the University of Illinois campus, Urbana.

Unconsolidated water-bearing sand and gravel deposits occur in a narrow band along the Ohio River and at the mouths of its tributaries in Hardin County. The uplands are covered by thin mantles of loess (wind blown materials), and rocks

of Pennsylvanian and Mississippian age are exposed at the surface in many places.

In the northern part of the county, water is obtained from the Pennsylvanian sandstones and the underlying Mississippian rocks. These rocks are extensively faulted throughout the county. Most wells in the southern part of the county are open only to the creviced Mississippian limestones, especially the St. Louis limestone.

Sand and gravel wells along the Ohio River valley may be as deep as 100 ft. Most bedrock wells in the upland areas are finished at depths less than 400 ft below land surface.

## Groundwater Development for Municipal Use

Unconsolidated sand and gravel deposits associated with the bottomlands of the Ohio River valley are tapped as a source of municipal water supply for the Hardin County Water District, located in the southeastern part of the county. The Water District well is 84.5 ft deep and its reported yield was 65 gpm upon completion. Ultimate yields, which are probably much in excess of this amount, depend primarily upon the type of well constructed and the permeability, thickness, and areal extent of the sand and gravel unit. Production from this well was estimated to be 12,000 gpd in 1972. Analyses of water from the well indicate that the iron content ranges from 1.6 to 3.1 mg/l, and the hardness

from 344 to 382 mg/l. Groundwater for the Water District is zeolite softened, chlorinated, and fluoridated.

A consolidated bedrock aquifer, Mississippian age creviced limestone, is tapped as the primary source of municipal supply for the village of Cave in Rock, located in the southeastern part of the county. The Cave in Rock well is 215 ft deep and its reported yield ranges from 92 to 105 gpm. The estimated production of this well was 20,000 gpd in 1973. Analyses of water from this well indicate that the iron content ranges from 0.15 to 0.2 mg/l, and the hardness from 270 to 307 mg/l. Water for Cave in Rock is chlorinated and fluoridated.

## Format

In this publication the descriptions of public groundwater supplies are presented in alphabetical order by place name.

At the beginning of each description the U. S. Census of population for 1970 is given for incorporated places. For unincorporated places, the population is estimated on the basis of the number of services or residential units and an assumed number of 3.5 persons per service.

The number of services and quantity of water distributed at each supply are given where available for the earliest and the latest reported values.

Individual production wells for each supply are described in the order of their construction. The description for each well includes the *aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses.*

The screen sizes given in this publication are for continuous slot screens. Slot sizes given indicate the width of the slot openings in thousandths of an inch. For example, a 20 slot screen has slot openings 0.020 in. wide and a 100 slot screen has slots 0.100 in. wide.

## Abbreviations Used

est.....	estimated
ft.....	foot (feet)
gpd.....	gallons per day
gpm.....	gallons per minute
hp.....	horsepower
hr.....	hour(s)
in.....	inch(es)
Lab.....	laboratory
me/l.....	milliequivalents per liter
mg/l.....	milligrams per liter
min.....	minute(s)
No.(s).....	number(s)
pc/l.....	picocuries per liter
R.....	range
T.....	township
TDH.....	total dynamic head

## CAVE IN ROCK

The village of Cave in Rock (503) installed a public water supply in 1961. One well is in use. This supply also furnishes water to the Cave-in-Rock State Park. In 1962 there were 122 services, all metered; the average daily pumpage was 15,000 gpd. In 1973 there were 195 services, all metered; the estimated average and maximum daily pumpages were 20,000 and 25,000 gpd, respectively. The water is chlorinated and fluoridated.

WELL NO. 1, finished in Mississippian age limestone, was completed in March 1961 to a depth of 220 ft (measured at 215 ft deep in 1963) by Allan Taylor, Marion, Ky. The well is located in the southwest part of the village, approximately 4550 ft Sand 1050 ft E of the NW corner of Section 13, T12S, R9E. The land surface elevation at the well is approximately 400 ft.

A drillers log of Well No. 1 follows:

Strata	Thickness (ft)	Depth (ft)
Soil	5	5
Sand, soft	15	20
Clay and gravel	5	25
Clay and boulders	5	30
Lime	14	44
Break	4	48
Lime	4	52
Break	2	54
Lime	10	64
Break	1	65
Lime	5	70
Break, clay and boulders	10	80
Lime	35	115
Lime, soft, breaks, water	10	125
Lime	2	127
Crack	3	130
Lime	45	175
Lime, soft	20	195
Lime	25	220

An 8-in. diameter hole was drilled to a depth of 220 ft. The well is cased with 8-in. pipe from 1.5 ft above land surface to a depth of 80.5 ft.

A production test was conducted on March 16, 1961, by representatives of the driller, the village, the State Water Survey, and Paul O. Hall & Associates, Consulting Engineers.

After 5.5 hr of pumping at rates of 92 to 110 gpm, the draw-down was 1.15 ft from a nonpumping water level of 73.05 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 73.10 ft. This water level is subject to change during periods of low river stages.

On December 15, 1962, the well reportedly produced 95 gpm for .35 min with a drawdown of 26 ft from a nonpumping water level of 109 ft.

Because of a limited yield, in November 1963 the Heldt-Monroe Co., Evansville, Ind., lowered the pump 50 ft and added 3 stages and a 10-hp motor to the turbine pump to try to increase the well capacity. During this time the Cave-in-Rock State Park furnished about 7000 gpd to the village.

The pumping equipment presently installed is a turbine pump set at 185 ft, rated at 130 gpm, and powered by a 10-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A106166) is for a water sample from the well collected November 13, 1973, after 45 min of pumping at 100 gpm.

### WELL NO. 1, LABORATORY NO. A106166

	mg/l	me/l		mg/l	me/l
Iron	Fe 0.15		Silica	SiO <sub>2</sub> 16	
Manganese	Mn 0.00		Fluoride	F 0.4	0.02
Ammonium	NH <sub>4</sub> 0.00	0.00	Boron	B 0.0	
Sodium	Na 6.3	0.27	Nitrate	NO <sub>3</sub> 6.2	0.10
Potassium	K 0.7	0.02	Chloride	Cl 2	0.06
Calcium	Ca 100	4.99	Sulfate	SO <sub>4</sub> 10	0.21
Magnesium	Mg 14	1.15	Alkalinity (as CaCO <sub>3</sub> )	288	5.76
Arsenic	As 0.00		Hardness (as CaCO <sub>3</sub> )	307	6.14
Barium	Ba 0.0				
Copper	Cu 0.00				
Cadmium	Cd 0.00		Total dissolved minerals	344	
Chromium	Cr 0.00				
Lead	Pb 0.00				
Mercury	Hg 0.0000		pH (as rec'd)	7.4	
Nickel	Ni 0.0		Radioactivity		
Selenium	Se 0.00		Alpha pc/l	1.5	
Silver	Ag 0.00		±deviation	1.1	
Cyanide	CN 0.000		Beta pc/l	0.2	
Zinc	Zn 0.03		±deviation	1.1	

## CAVE-IN-ROCK STATE PARK

Cave-in-Rock State Park, located 0.5 mile east of Cave in Rock, installed a public water supply in 1953. Water was obtained from a limestone well until October 1969 when the park area was connected to the Cave in Rock village water supply.

PARK WELL NO. 1, finished in Mississippian age limestone, was completed in September 1939 to a depth of 170 ft by Arthur O. Moreland, Cave in Rock. This well was abandoned in 1969 and sealed in January 1973. The well was located on the north side of the park on a hill behind

the custodian's home, approximately 1025 ft N and 1025 ft W of the SE corner of Section 13, T12S, R9E. The land surface elevation at the well is approximately 370 ft.

An 8.2-in. diameter note was drilled to a depth of 60 ft and finished 6.2 in. in diameter from 60 to 170 ft. The well was cased with 6.2-in. pipe from within a concrete pump platform to a depth of 60 ft.

Upon completion, the well reportedly produced 30 gpm with a drawdown of 45 ft from a nonpumping water level of 80 ft below land surface.

A drillers log of Park Well No. 1 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>	<i>Strata (continued)</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Soil and clay	17	17	Lime boulders, gray; mud, red	1.5	114
Hard boulders and mud seam	13	30	Mud openings and some boulders	1	115
Lime, hard, gray and brown	5	35	Lime, dark gray, and some seams	10	125
Lime, hard, gray	30	65	Lime, gray; some flint	5	130
Lime, hard, blue	15	80	Lime boulders	5	135
Little blue lime, hard, brown	32.5	112.5	Limestone, shelly	10	145
			Lime, hard, dark gray	15	160
			Lime, medium gray and brown	10	170

## HARDIN COUNTY WATER DISTRICT

The Hardin County Water District (est. 615) installed a public water supply in 1972. The Water District treatment plant is located 1 mile east of Cave in Rock. The system consists of approximately 25 miles of water main which surrounds Cave in Rock and stretches west along Ill. Route 146 approximately 9 miles and north along Ill. Route 1 approximately 5 miles. One well is in use. In 1972 there were 278 services, all metered; the average and maximum daily pump-ages were 12,000 and 20,000 gpd, respectively. The water is zeolite softened, chlorinated, and fluoridated.

Four test holes ranging in depth from 26 to 87 ft were drilled by E. C. Baker & Sons, Sigel, prior to the installation of a public water supply for the Water District. They were located in Sections 17 and 18, T12S, R10E.

WELL NO. 1, finished in sand and gravel, was completed in August 1970 to a depth of 84.5 ft by E. C. Baker & Sons, Sigel. The well is located 0.5 mile east-southeast of the water treatment plant about 500 ft N of the Ohio River, approximately 2440 ft N and 320 ft E of the SW corner of Section 17, T12S, R10E. The land surface elevation at the well is approximately 330 ft.

A drillers log of Well No. 1 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Soil, yellow clay	30	30
Blue clay	5	35
Yellow sand, some gravel	19	54
Blue clay	1	55
Blue sand, some gravel	28	83
Green sandy clay	1.5	84.5

A 20-in. diameter hole was drilled to a depth of 84.5 ft. The well is cased with 8-in. steel pipe from 25 ft above land surface to a depth of 69.5 ft followed by 15 ft of 7.5-in. No. 25 slot Cook brass screen. The annulus between the bore hole and casing-screen assembly is filled with concrete from 7 to 20 ft, with fill sand from 20 to 49.5 ft, and with

Texas Mining Co. No. 16-30 sand from 49.5 to 84.5 ft. A 24-in. concrete casing is placed from 6 ft above land surface to a depth of 7 ft to provide flood protection.

A production test was conducted on August 14, 1970, by representatives of the driller, the village, the State Water Survey, and R. A. Nack & Associates, Consulting Engineers. After 3 hr of pumping at a rate of 65 gpm, the drawdown was 37.27 ft from a nonpumping water level of 30.17 ft below land surface. On the basis of the production test data, it was estimated that this well would yield 50 gpm (72,000 gpd) on a long-term basis.

The pumping equipment presently installed is a Jacuzzi submersible pump (Model No. 10S6A20-TZ) set at 69 ft, rated at 50 gpm at about 70 ft TDH, and powered by a 10-hp Jacuzzi electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B9545) is for a water sample from the well collected August 23, 1972, after 1 hr of pumping at 60 gpm.

### WELL NO. 1, LABORATORY NO. B9545

	<i>mg/l</i>	<i>me/l</i>	<i>mg/l</i>	<i>me/l</i>
Iron	Fe 1.6	0.06	Silica	SiO <sub>2</sub> 20
Manganese	Mn 0.1	0.00	Fluoride	F 0.3
Ammonium	NH <sub>4</sub> 0.3	0.02	Boron	B 0.5
Sodium	Na 10.9	0.47	Nitrate	NO <sub>3</sub> 0.0
Potassium	K 0.8	0.16	Chloride	Cl 6
Calcium	Ca 98.9	4.94	Sulfate	SO <sub>4</sub> 34
Magnesium	Mg 32.8	2.70	Alkalinity (as CaCO <sub>3</sub> )	356
Arsenic	As 0.00		Hardness (as CaCO <sub>3</sub> )	382
Barium	Ba 0.10			
Copper	Cu 0.02		Total dissolved minerals	422
Cadmium	Cd 0.00			
Chromium	Cr 0.00		pH (as rec'd)	7.4
Lead	Pb 0.00		Radioactivity	
Mercury	Hg 0.0000		Alpha pc/l	0.0
Nickel	Ni 0.0		±deviation	1.5
Selenium	Se 0.00		Beta pc/l	2.8
Silver	Ag 0.02		±deviation	2.2
Zinc	Zn 0.0			